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APPLE GROWING.

by

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The italics in this article are by the principal and are intended to call special attention to these passages, which should be carefully studied as an aid in examinations and to fix these points in the memory.

APPLE GROWING.

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Growing the apple to the perfection to which it may be grown under good orchard management is an art. Apple production is not so difficult, however, that good results may not be had by the person, who, though unfamiliar with this line of work, makes a study of apple orcharding and applies the principles of the business in his field management. The many unsolved and rapidly increasing problems *make it necessary for every grower to keep in close touch with his work.* In fact there are so many factors influencing the industry at this time that it will require the cooperation of all interested in the industry to place the business on a basis so that the returns will justify the production of the apple viewed from a financial point of view.

The planting of large areas of land by development concerns and the sale of these young orchards to persons in many cases entirely unfamiliar with any phase of orcharding has brought about a condition presenting many and perplexing problems. A brief survey of these problems by an expert apple grower shows that it will take much careful work to solve even the more urgent of these problems. *The first and perhaps the most important undertaking is the training of the inexperienced persons in possession of the property.* One of the means through which much valuable service can be rendered is the paper dealing with the subject in a general way but giving sufficient information to be of direct and immediate value. Also to serve as a guide for a more extensive study, *a study which every apple grower must make to be successful.*

The conditions at the present time (1912) are such as to give apple growing a decided check or set-back. This is true, at least in some of the sections where apple growing has been a profitable business. Present conditions indicate that marketing the fruit will ultimately be adjusted and apple production will become a more permanent and profitable occupation minus much of the speculative aspects now accompanying this line of work. By making a study

of the business of production and cooperating to the full extent in the marketing of the *best apples* as fresh fruit and the utilization of the poor grades in the preparations of the various products such as vinegar, cider, apple butter, etc., the problems of distribution can be solved. The demand made by the commission man and the consumer for certain varieties will soon inform the grower with reference to this point. The undesirable varieties may be top-worked to commercial ones. The trees now occupying unproductive land will be dug up and the soil planted to crops to which it is adapted. In the neighborhoods where warehouses and factories take care of the entire output the soils suitable for apple production, no doubt, will be planted. In fact, a condition will be brought about so that the investor who becomes an apple grower and not a land speculator, will not only *find* this line of *work profitable* but as *enjoyable* as any line of farm work in which he might engage.

SELECTING A SECTION FOR GROWING THE APPLE.

It is not uncommon to note, in many advertisements concerning the sale of apple lands, that "this section will grow just as good apples as can be grown in HOOD RIVER." Unless such a section presents more than ordinary opportunities, and has been recognized as an apple producing section at least in a small way, it is unwise for a person who is unfamiliar with conditions desirable for apple growing, to invest in such a section until thoroughly informed relative to the future possibilities of said place. It is far more advisable to engage in the industry in a section in which much success has been attained by those experienced in the business and the products have also become well known. One should always bear in mind in selecting orchard land in any valley or section that there is not a single area in which there does not occur larger or smaller areas of land entirely unfit for growing the apple. Many times the desired information may be had by consulting an expert horticulturist.

At this time when poor distribution of the crop really threatens the industry, it is more than advisable to inquire into the conditions of the market relative to the demand and the sales of fruit grown in the section. When a majority of the trees are young, a high percent of the fruit will be extra fancy. It should be remembered that as the trees grow older the percent of poor grades will increase

very rapidly. The cost of production will also increase. Such a condition requires that all the *cheaper grades* of fruit should be *worked up as by-products* in order to prevent their being placed upon the market in competition with the better grades, and also to prevent a large loss since failure to use these inferior apples usually causes a loss equal to the running expenses of the year.

The apple is easily influenced in keeping quality through delayed storage. One cannot too strongly urge selecting a location in which common and cold storage facilities are available and a shipping association are doing an active and profitable business, also that a good healthy spirit of cooperation is present, as it will not be many years before all of the fruit to be handled to good advantage must be handled through cooperative marketing associations.

Caring for the orchard and crop requires reliable help at certain portions of the season and for this reason one should carefully consider available help during such a time. The person so situated as to make it difficult to secure help as needed will experience much trouble and perhaps financial loss. It will be most difficult for the apple grower with a small acreage who cannot afford steady work for the pickers for a considerable length of time.

Remoteness from a warehouse or shipping center is perhaps as important a consideration as any, especially in sections where roads are rough and become almost impassable with the advent of winter rains. The distance from the point of delivery and the conditions through which the fruit must pass before delivery, usually determines the limits of any location for growing fruit. This is particularly true concerning the apple.

Many people unfamiliar with the prices of farm lands, and a reasonable net return per acre for highly developed properties, have failed to carefully figure their investment before deciding upon a location. Many of the so-called apple lands, as well as good apple lands, have been sold for exorbitant prices. Such a mistake on the part of the buyer is a sad one. It will take much hard labor and management to recover on the investment and secure a reasonable income.

Too often too little attention is paid to the *amount of moisture available* in a section. Large volumes of water are required to develop maximum crops of apples. In case the rainfall is light, mois-

ture must be supplied. For this reason one should inquire carefully concerning water for irrigation and the cost if the same is available. After having duly considered all of the above points one is prepared to look for land suitable for apple culture.

In settling in a new locality often too little attention is paid to the *social, religious and educational advantages*. The family of growing children have their future before them and it is the duty of the parents to see that their advantages are at least reasonable.

Lastly comes the matter of financing the business since apple growing is a business which requires as much fore-sight and management as any line of work. Other than the purchase price of the land, if the orchard has not begun to produce returns that will meet all the expenses, provision must be made for an income until the orchard does produce a living. *Inter-cropping* often times is the most desirable undertaking. Some inquiry as to the kinds of inter-crops and market for the same may in many cases indicate the source for a livelihood.

SELECTING LAND SUITABLE TO APPLE CULTURE.

The types of soils, in which apples will grow and do remarkably well, vary greatly. A *loose, loamy type* varying from *four to six feet* or more in depth underlaid with a *good subsoil* makes a most desirable soil. The subsoil should be of such a character as to retain large quantities of moisture, yet porous enough to admit of *good drainage*. In many localities certain areas at certain seasons, appear to be adapted to apple growing, yet at other times these same lands are found to be either extremely dry or contain too much moisture to give the most suitable conditions.

Air drainage as well as soil drainage should be *carefully considered*. Even the casual observer can quite readily determine this condition for himself if he remembers the fact that *cold air collects in low places*. *Temperature records* are usually available which show the prevalence of frosty or freezing weather conditions during blooming time and later. In case *orchard heating* is necessary be sure to figure the value and cost.

Determine if the *rainfall is sufficient* and that the soil will hold enough water to mature more than the average crop. The careful inspection of rainfall records will oftentimes give the desired information relative to moisture supply. In considering this point it

should be remembered that the orchard after the first ten or twelve years must have larger quantities of water to mature maximum crops. Young trees while making a vegetative growth, usually find a sufficient quantity of water to meet their needs even in the soils of low water holding capacity. As the trees grow, however, the supply of moisture may not be sufficient to produce the necessary wood growth and mature the crop of fruit which old trees must bear in order to produce paying returns.

The *exposure* of the land should be considered, especially if intercropping is to be practiced. A southerly exposure is a warmer slope and is better adapted to intercropping than other slopes.

One serious mistake and oftentimes met with, is the failure to recognize *seepage conditions*. In localities where free water comes to the surface during the wetter portion of the season, it is not advisable to attempt to grow the apple unless the land is thoroughly drained. As a usual thing such types of soils are too compact. Where seepage conditions do occur it is generally recognized even in orchard sections that such soils should be utilized for growing forage crops.

In many of the apple growing sections where irrigation is being practiced, little attention has been paid to the *presence of alkali*, in fact, it has been the more common custom for the real estate dealer to refrain from informing the embryo-apple grower concerning the presence and formation of alkali. Many purchasers, therefore, have come into possession of areas in which alkali salts are accumulating at such a rate that it will not be long before the land is rendered unfit for apple production and possibly entirely unproductive of agricultural plants.

Seldom do prospective purchasers inquire concerning *prevalent winds*, drifting sands, etc. In some localities very good results have been obtained in growing wind breaks. This is advisable in localities in which the wind is too strong to permit young trees to make a normal, even top development.

Information concerning *elevations* with reference to snowfall is seldom considered, yet in some localities where apple growing is gaining a foothold, the snowfall is so heavy that it is doubtful whether young trees can be brought into bearing owing to damages wrought by heavy snowfalls followed by rapid thawing and

freezing weather, conditions under which the snow settles, tearing off the branches and breaking down some of the trees.

Information should also be sought relative to the *maturity of standard varieties* of apples at various elevations and exposures. This is a very important point since many of the varieties change in their nature at various elevations and exposures and may prove to be undesirable.

PREPARING THE ORCHARD LAND.

A very large proportion of the land upon which trees have been planted, has been cleared of sage brush or timber. It has been customary to clear the smaller tracts by hand grubbing, sometimes employing powder and a stump puller in the heavier clearing, but doing a large proportion of the work by hand. Where the acreage cleared has been considerable, the more serviceable method has been through the use of powder and a donkey engine. When following this method it is the general plan to cut all standing timber, slash the undergrowth during June and later, and burning over the area just before the fall rains begin. By this method a very large proportion of the coarser material, as well as all of the finer, is destroyed. Such refuse as can be handled by hand is gathered and burned; the stumps are then cracked by using small charges of powder after which the same are pulled and piled in large heaps for burning. By using a powerful engine, well manned with a good crew of workers, this method is a good one if sufficient ready money is available to meet the cash outlay necessary to operate such an outfit. For the man who has purchased a small tract for developing a small orchard, no method is more serviceable and inexpensive than the *char-pit* method of destroying stumps provided the type of soil is of the nature which admits following this method. The great advantage of this method is the small amount of cash necessary to do effective work at little more than an expense of time.

In any of the methods followed it should be the aim to clear the land of all material, removing all of the stumps and as many of the small roots as possible. Thoroughly cleared land will produce a better orchard than poorly cleared land. A serious mistake is often-times made in planting the young trees in newly cleared soil which has not been stirred properly. In many cases these virgin soils are deficient in humus and nitrogen. Grown under such conditions young

trees do not make as vigorous and strong a growth as desired. An excellent plan to follow, and one which puts the land in the best condition, is, to grow a crop of vetch or clover, after which the ground may be prepared for planting the trees. The cover or shade crops grown may be cut for hay or turned under as a green manure.

SELECTING AND PLANTING THE TREES.

The evil effects of planting a few trees of each variety that strikes ones fancy is being felt at the present time by the owner of the orchard in which promiscuous varieties were planted. Concerning the old system of planting the only use we can make of the same is in planting the *home orchard*.

Selecting varieties for the home orchard is a comparatively easy task since the plan usually followed consists in figuring the space to be planted and then to select the most desirable of both early and late maturing apples that may meet ones fancy. The main point to be considered is the relative proportion of early or late varieties that will meet the requirements of the family. Where space does not admit of growing all the varieties desired, very satisfactory results may be had in growing two or more varieties on the same top. In working over the tree the main thing to bear in mind is the relative growth of the varieties. Small and slow growing varieties should be grouped. Since standard varieties come into bearing rather late it is desirable in case early fruit production is desired to secure semi-dwarf or dwarf forms of the standard sorts. These dwarf trees require more care and training than the standards, however, but nevertheless, make desirable and profitable trees for the city lot or small ranch where space is a serious consideration.

In preparing to plant the commercial orchard the first problem is the selection of varieties. One must consider the adaptability of the varieties to the types of soil and soil conditions as well as forecast their probable commercial value. Size, color, flavor and the actual span of life of the fruit in common and cold storage are points of serious consideration at this time in the development of a commercial orchard.

In the older apple growing sections the selection of varieties is not difficult. A majority of the commercial varieties are represented by a few specimens which show their desirability and adaptability. In valleys like the Hood River or Wenatchee, certain varieties are

recognized as profitable commercial forms. It would be unwise in planting in any such locality to attempt to grow quantities of other than standard sorts since it is necessary to have large shipments of every variety to secure good prices.

The arrangement and number of varieties in an orchard must be determined after the area to be planted and varieties have been decided. Good information can be had from the growers relative to the adaptability of varieties as pollenizers for standard sorts where pollenizers other than commercial sorts are deemed advisable. Recent investigations have clearly demonstrated, that, while some varieties are self fertile, partially sterile or entirely so, *all varieties set more and better fruit when fertilized by pollen other than their own*, a fact particularly evident during such years as weather conditions are adverse to the setting of fruit. In planting, each variety should be planted in either two, four, six or more rows in a block in order to facilitate spraying, picking, etc.

Since it is advisable to have two or more varieties growing in the same area, the foremost and important consideration is the selection of varieties that come *into blooming at the same time or nearly so*. The larger the orchard, the greater number of varieties and the trees of each variety, the less important the selection of close blooming sorts becomes. In the arrangements in large orchards the varieties that bloom at the same time should be placed in the same block. There is sufficient evidence to show that yellow and red sorts may be intermingled as the color of one does not influence that of the other enough to materially modify the color.

Having selected the varieties and decided the proportions of each to plant one must decide which of the systems of planting to be followed and the distance apart to place the trees in order to determine the number of trees required to plant a given area.*

The *rectangular system*, in which the trees are planted in rectangular squares, is the most common system employed. The arrangement admits of *ease in intercropping* while the trees are young and of cultivation and other care when larger. Should one decide to use this system, and especially where *fillers are utilized* or the trees are placed close together so that it will become necessary to remove a part of them at the time they come into heavy bearing,

(Ed. Note—For table giving the number of trees and distance apart to plant an acre by each of the three systems in use see page 8 "Planting Fruit Trees" by H. C. Atwell, one of the articles used in this course.

great care should be taken to plan the work carefully or the removal of the fillers may give an arrangement of the remaining trees that is *anything but desirable*.

The *hexagonal system* permits planting a larger number of trees per acre than the rectangular. This system is really *based on the circle* and the trees are planted in circles of six with a seventh at the center of the circle. This arrangement places the trees *equally distant* apart and admits of equal exposure to light and air. *Cultivation and spraying* among large trees *sometimes becomes rather difficult* but on the whole the system is a fairly satisfactory one.

The *quincunx system* is in some respects an ideal one. The arrangement allows a very large number of trees per acre and is therefore most *desirable where fillers* are used. This system differs from the rectangular in that the trees are in *groups of five in rectangles or squares* with a *fifth tree* at the center.

In selecting trees for planting, *one-year-old tops* on a two or three year old root, are the most desirable. These whips should be four to six feet in height, about five-eighths or a little larger in diameter at the base and provided with well developed buds throughout. Great care should be taken by the planter to carefully examine each tree in order to discard each one showing diseased condition of the root system. Frequently trees free from disease of any kind are poorly developed and should be discarded with as much care. Inferior stock seldom produces desirable trees. There is a general neglect among persons engaged in various lines of apple growing to pay too little attention to the source of stock. Bud sticks and scion stock should be taken from healthy trees of known varieties and of known yield. This system will give as uniform a lot of trees as can be secured.

It is very evident that budding is a more desirable practice in propagating trees than grafting, since budded trees are less susceptible to crown gall and hairy root.

With respect to the inspection of trees for planting, it is desirable to make the inspection at the time the trees are dug from the nursery rows. At this time the roots are fresh and bright and the diseased trees can be more readily discarded than at a later date. Too little attention is paid to protecting the roots at the time of digging, and thereafter until the trees have been set permanently in the orchard. Exposed as they sometimes are, it is certainly re-

markable that more trees do not fail to grow or make a satisfactory growth.

Digging holes for the trees is a very important matter. The holes should be large and the dirt well mixed in order to make a good seed bed for the young tree. In soils which have been utilized for growing grain and other crops or where the soil is heavy, the best results are obtained by mellowing the subsoil by using a part of a stick of low grade stumping powder.

Planting may be done during the spring or autumn. Autumn planting is least advisable since in many cases it is impossible to secure well matured trees by the time planting should be done. Fall planting has an advantage, however, in that the soil becomes *well firmed around the roots* of the trees before the advent of growing weather. *Before setting*, the roots of the young trees should be carefully inspected and *trimmed* in order to remove all broken and mutilated ones. When the tree is placed the dirt should be *packed firmly around the roots* being well worked in among the root branches. Very frequently trees have been planted by plowing them in, digging a small hole with a shovel or similar tool and packing the roots closely together or by standing them in the hole and filling in with loose dirt. Results can only be had by digging a large hole and carefully placing the dirt, taking care to firm the same around the roots as the planting is done. *After the planting* has been completed, the *top may be cut* off about thirty inches from the ground. Topping at this height admits of a good distribution of scaffold branches.

(Ed. Note—In many sections trees are cut back to from 20 to 26 inches.)

TENDING THE YOUNG ORCHARD.

Immediately following the planting the ground around the trees should be stirred in order to form a *dust mulch* to conserve the moisture. Different types of soils require the use of different kinds of tools and different methods of handling. As a usual thing information concerning the best types of tools can be had by inquiring of an experienced orchard man.

Usually, in irrigated districts, it is not necessary to irrigate young trees during the first season. Should the ground show a lack of moisture during planting or any time thereafter during the summer, a light application of water should be made. It is a far better

practice to give young trees enough moisture to give them a good vigorous start than to allow them to stand still as they do under some conditions. The amount of water applied depends very largely on the water holding capacity of the soil to be irrigated, the length or rills, etc.

PRUNING.

Various methods of pruning are practiced in the training of young trees. The more common one is to cut off all of the young branches not intended for scaffold branches shortly after they have grown a few inches in length. This allows the entire strength to be thrown into the remaining branches, thus increasing their length and diameter. The following spring the scaffold branches are cut back to twelve to fifteen inches to induce them to produce laterals. Another method, and one which works very well in the hands of an experienced pruner, is the method of saving nearly all of the wood growth by *summer pruning*. Under this method the branches are allowed to grow long enough and of sufficient diameter to show fairly well matured buds at which time these branches are cut back to the place where branching is desirable. Cutting at this time induces them to throw one or more branches. If one is fortunate enough to secure two or more branches, the method may be considered a successful one. These secondary branches are trimmed back the following spring in order to induce them to fork at the points where branching is necessary to give the tree the proper shape.

As usually practiced, the pruning is too severe, with a result that young trees do not come into bearing as soon as they might. Most of the pruning should be done during the first two years. During this time cutting back should be severe enough to force the trees to produce the necessary shape, afterward, however, pruning should be done at any and all times of the year when the work is necessary to train the trees as desired. It should be borne in mind that light cutting at different times of the season is far more desirable and gives better results than heavy cutting at any time of the year, either winter or summer.

PESTS AND DISEASES.

Attention has been called to the fact that all young trees when planted should be free from disease. After planting the only pest apt to do serious damage to the root of the young tree is the gopher.

When the land is thoroughly cleared and especially where considerable powder has been used, few or no gophers appear except around the edges of the field. These places become infested by animals entering the field from adjoining tracts. The only effective method of getting rid of these pests is by trapping or poisoning, or both.

A very injurious insect pest known as the *bud weevil* has done considerable injury in some of the young orchards and nurseries. It is believed that the greater number of these insects climb up the tree. A very successful method of protecting the trees is to place pieces of tin around the stems near the ground in order to prevent them from going up the stem; the smooth surface of the tin does not allow the insect to crawl up it. Topping newly set trees after the weevil quits work is an effective way to save the lower buds from which the scaffold branches may be developed, since only the uppermost buds are destroyed by this pest. Tanglefoot placed on a strip of cloth or paper placed around the tree will also prevent the weevil from climbing up the tree.

In poorly cleared and newly cleared land, *grub worms* are sometimes very abundant. When such is the case it is necessary to remove the dirt around the crown and main roots of the young trees, and collect the worms, which work principally on the outside eating away the bark and young wood.

Flathead borers which are rather common in many sections especially adjacent to timbered areas, can be kept out of the young trees by placing collars of paper or yucca around them at the time of planting.

There are a number of *leaf eating insects* which attack young trees; all of these may be killed or at least the plants *can be protected* so that little or no injury is done, by the *use of arsenicals*, preferably an arsenate of lead; the application of this material should be made as soon as the work of the insects becomes noticeable.

Apple scab is also apt to become abundant on young trees; if such is the case the leaves should be sprayed with Bordeaux (4-4-50) while bearing trees are in full bloom. *Anthracnose* or *black spot canker* is also very apt to become abundant and for this reason the young tree should receive another application of Bordeaux mixture early in the autumn before the leaves drop off and the fall rains begin. Spraying at this time also aids in checking apple scab.

Aphides, especially the green aphid and red spider, attack and

do serious injury to many of the young trees unless kept in check by spraying with Black Leaf 40 and whale oil soap.

INTERCROPS.

The owners of most five and ten acre tracts find that it is necessary to secure some return by growing crops between the rows of young apple trees. The principal thing to bear in mind in intercropping is to give the young apple trees *sufficient space*. At no time should a crop be grown closer than three or four feet outside the top unless the same is a cover or shade crop. It is also advisable to grow such crops as require about the same amount of moisture. A *frequent mistake* in intercropping is made in *growing strawberries very close to young trees*. Strawberries require and use several times the quantity that can be utilized by young trees. When grown together the trees must either suffer from an over-supply or the strawberries must be allowed to suffer from a shortage. In cases where plants requiring a high percent of moisture are grown between young trees and irrigation is practiced, water should be applied as far from the young trees as advisable allowing the moisture to spread laterally through the soil.

FILLERS.

Much information is asked concerning the use of fillers. Any kind of tree or bush fruit may be used. In planting fillers one must bear in mind that all fillers must be cut out at the time the apple trees have become large enough to use all of the space. Unless one can remove the fillers, although they are producing a fair income, it would be best to leave out the same.

DRAINAGE.

In all cases where land needs draining such work should not be neglected. As a usual thing tile placed at a depth of three and one-half to four feet gives the best service, unless conditions are such that an open ditch may be utilized. The distance apart that tile may be placed depends upon the condition as well as on the physical structure of the soil. Tiling gives the best results when the quantity of water passing through the system fills the pipes nearly full. In laying the tile the gradient should not be less than two inches to 100 feet and should be uniform for a given distance. The tile should be placed snugly together and at exactly the same slope in order to prevent places in which silt or sand might collect. All lateral branches

where joined to the main line should join at an angle of less than forty-five degrees and the opening should be through the top of the main tile. This prevents backwater from causing sand or other materials to settle in the tile. The outlet of the entire system should be well protected in order to prevent clogging by dirt being tramped around it or by settling of sand by backwater.

In localities where heavy snows tear off the branches of young trees or break them off, it becomes necessary to drive stakes by young and weak trees to which they are tied by a strong twine; the most robust trees may be protected by merely tying the lower branches together in a bunch. The tying should be done at two or more places according to the size of the tree. In cases where the trees become broken and it is desirable to save the torn branches, the same may be brought back in place and held by a string tied to some portion of the tree. The branches may be held rigidly in place by the use of galvanized shingle nails or small screws. The wounded portion should be either coated over with thick white lead paint or some form of grafting wax that will exclude moisture.

TENDING THE BEARING ORCHARD.

By the time the orchard comes into bearing each tree should have been *labeled* with some convenient label which will stand the weather for many seasons. Accurate records of the yield of trees in an orchard has shown that some of them never produce paying crops. While it is fairly easy to keep record of the behavior of the trees in a small orchard without labeling, it is impossible in a large one. The proper labeling of trees makes it very easy to keep records of the condition of any tree in the orchard regardless of extent by merely referring to it by number. This system also has an advantage in that individual trees can be quickly and accurately located, even in the center of very large tracts by noting the number of the tree.

Clean cultivation has generally been recommended for the bearing orchard. Various systems of orchard management have shown that some clean cultivation is a good practice when alternated with shade or cover crops or both according to the condition of the trees and soil.

COVER CROPS.

A *cover crop* of common vetch sown alone or with some form of grain such as rye, oats or wheat, has been recommended generally.

Sowing during the middle of August and later with a drill is the usual method, applying the vetch alone at the rate of 120 pounds per acre or 40 to 50 pounds with rye (20 pounds), wheat (40 pounds), or oats (30 pounds). In heavy bearing orchards where numerous stakes are required to support the limbs heavily laden with fruit, it is impossible to follow these recommendations. The sowing of the seed following the gathering of the fruit is usually done so late that little or no growth is secured from the cover crop.

Tests conducted with various kinds of cover crops show that there are a large number of forms adaptable to our conditions. It is also evident that some of these forms are much more valuable on definite types of soils than some forms which have generally been utilized up to this time. For this reason it is advisable to give cover crops a much more thorough and extensive test than has been made. In doing this work one should bear in mind the nature of the plant, whether leguminous, annual or biennial, shallow or deep rooted, and whether the root is coarse or delicate. All plants should be studied with especial reference to *their action upon the soil* during the growing period as well as after the same have been worked into the soil and are changing to humus.

All forms of plants regardless of their natures, when worked into the soil *add humus* and improve the physical and chemical condition of the soil. *Leguminous plants*; alfalfa, bur clover, common clover, red and white clover, vetch, peas, beans, cow peas, soy beans, etc.,—in addition to humus *add nitrogen* to the soil in all cases when the growth of these plants is normal. *Rape, kale, turnips* and similar plants are heavy feeders *on potash* and may be utilized to liberate this plant food. Other plants feeding heavily on *phosphoric acid* or lime may be utilized in the same manner. The condition of the trees and land determine the use of the various cover crops and the rotation of the same.

Spring planting of crops to improve the condition of the soil usually gives more satisfactory results than autumn seeding. For this reason the more desirable of the cover crops should be given a trial as shade crops. The work with shade crops has demonstrated that their action is probably more effective than as cover crops. *Shade crops* aid in maintaining a more even temperature in the soil, and with the application of sufficient moisture so timed as to keep the soil uniformly moist, apparently provides conditions under which

a lesser percent of physiological troubles of the tree and fruit appears.

Irrigation is believed to be desirable on all types of soils. If the soil and subsoil are of such a nature that the water holding capacity is great enough to hold and supply the trees uniformly throughout the season, no irrigation is necessary. Large quantities and a constant supply of water are necessary for the development of the trees and the production of the fruit. In case the soil does not hold sufficient water to do this work, and many of them do not, the water must be supplied through irrigation unless the rainfall through the growing season is sufficient to meet the demand.

Types of soils usually are such or the subsoil conditions such that it is impossible to induce the soil to hold sufficient water during the entire season, and yet remain in good physical condition at all times to allow the trees to produce a maximum crop of fruit. Conditions where soil drainage is perfect during the spring and water is available the remainder of the season make a more suitable location for growing the apple than a non-irrigated area. Water applied in quantities at intervals so that the moisture is kept constant in the same proportion throughout the season, but is not more abundant than admits of proper bacterial action, provides the best conditions for tree growth and fruit production.

CHEMICAL ELEMENTS.

Through *chemical analyses some fifteen elements are found in plants*—carbon, hydrogen, oxygen, nitrogen, sulphur, phosphorus, potassium, magnesium, iron, chlorine, aluminum, sodium and silica. The last four have not been proven to be essential. The remaining with the exception of *nitrogen, phosphorus, potassium, and calcium*, are usually present in sufficient quantities to supply the plants. In case the growth of trees or yield of fruit is not satisfactory the results may be due to a lack of one or more of these *four elements*. A close study of the existing conditions or an application of one or more carriers of each of these four elements may give the desired results.

In attempting to prove the use of any fertilizer the facts concerning the use and action of the carriers of the four named elements should be understood. It should also be remembered that in order to get results from fertilizers, it is necessary to have the soil in as good physical condition as possible and to also see that there is a constant

supply of moisture and in proportion to the requirements of the plant. The time of application depends upon the nature of the fertilizer—whether the same becomes fixed in the soil or will leach out, immediate or slow acting.

NITROGEN. Plants suffering from a lack of nitrogen show poor stem growth, the foliage is small and becomes a sickly yellow color. When the supply is in excess vegetative growth takes place at the expense of fruit and flower buds. The foliage becomes large, deep colored and the wood growth is greatly accelerated. Because of this effect it is necessary to exercise care in the use of any fertilizer supplying this element.

Nitrogen is an organic element and is largely derived *from the air*. It is the *most expensive* of all the fertilizer elements. It can be secured very cheaply, however, through use of leguminous cover or shade crops. The same may also be applied in nitrate of soda, nitrate of lime, ammonium sulphate, dried blood, etc.

PHOSPHORUS. This element is essential to and promotes the growth of the plant which without the required amount will die. It also overcomes or holds in check the stimulating effect of nitrogen and hastens maturity. Fertilizing materials in which phosphorus occurs also render soil ingredients more available for plant use. An application of a phosphate fertilizer usually increases the yield.

Phosphorus is a chemical element occurring in phosphate rock and its products such as acid phosphate or super phosphate, bone and bone products, basic slag, etc.

POTASSIUM. Potassium is essential to every living cell of the plant. It is also connected with the formation and movements of products of the cell, especially starch. The flesh portions of fruit do not develop satisfactorily in case of a deficiency of this element.

Being a chemical element and occurring in large proportions in combination with other elements the same is easily secured through the use of muriate or sulphate of potash, kainit or mixtures of these potash compounds or wood ashes.

CALCIUM. This element is intimately associated with the solution and transference of starch within the plant, in fact calcium acts as a general cell invigorator.

Nitrate of lime, ground raw lime rock, ground shells, land

plaster, air slaked and water slaked lime are the principal carriers of lime used as fertilizers.

A promiscuous use of any form of *lime* should not be made until its use is determined experimentally. A large series of tests made by the writer indicates that lime compounds, and especially air slaked lime, may do marked injury. Through experiments with air slaked lime on apple trees it is apparently dangerous to apply lime on a soil poor in mechanical condition and deficient in nitrogen.

Mixed fertilizers. There are many mixed fertilizers which are apparently worthy of consideration. Animal and guano fertilizers and mixtures in which they form a good proportion, give very good results in many cases. A test with such fertilizers will determine their economic use.

Use of fertilizers. Chemical analysis of the soil is only valuable as an indicator of the proportion of a plant food element occurring in a soil. The analysis does not show how much of the plant food can be utilized by a plant.

The use of fertilizers can only be determined through their actual use. The chemical and physical action on the soil of each of the various carriers of nitrogen, potassium, phosphorus and calcium vary with each compound. *Combinations* of the various compound also give different results than when applied alone. Through chemical analysis of apple the kinds of substances and proportions used have been determined. This data has been used as a basis for determining the amount of each kind of fertilizer to use in adding substances to the soil to increase the proportions of food for the plant with the object of increasing the yield. The information necessary as a guide for the application of fertilizers follows:

Kind of Fertilizer	Pounds	Kind of Food			
		Nitrogen	Potash	Phosphoric Acid	Lime
Nitrate of Soda . . .	50 to 100	16	--	--	--
Sulphate of Ammonia .	40 to 80	20	--	--	--
Dried Blood	80 to 160	10	--	1	--
Stable Manure . . .	1500 to 3000	2	1	--	--
Nitrate of Lime . . .	50 to 100	13	--	--	25
Nitrate of Potash . .	50 to 100	13	--	--	--
Wood Ashes	1000 to 2000	--	5	1.5	--
Carmallite		--	13		
Kainit			12.5		
Muriate of Potash . .			50		
Sulphate of Potash . .			50		
Bone Meal	300 to 600	--	--	20	44
Acid Phosphate . . .	250 to 500	--	--	12	--

Kind of Fertilizer	Pounds	Kind of Food			
		Nitrogen	Potash	Phosphoric Acid	Lime
Tankage	300 to 600	6	--	10	--
Basic Slag	300 to 600	--	--	20	44
Pulverized Limé Stone	500 to 1500	--	--	--	--
Caustic Lime	500 to 1500				
Air-Slaked Lime	500 to 1500				
Hydrated Lime	500 to 1500				
Land Plaster	100 to 150				

(Ed. Note—For further information on Chemical Elements along this line see "Soil Fertility and Permanent Agriculture" by Hopkins; also see article in this course on "Soil Fertility" by H. V. Tartar and to those desiring a larger work use "Soils" by Prof. Hilgard.

At the time the orchard comes into bearing it is supposed that the trees have been properly trained. It is to be remembered that at this time that the trees should be pruned lightly during both winter and summer. *Winter pruning* should consist of slight heading in and the removing of crossing, weak or diseased branches. *Summer pruning*, which should be done during the *latter part of July and early August*, should consist very largely of heading back in order to induce the trees to set strong fruit buds. Heavy cutting during the winter or summer has a tendency to throw the tree out of bearing although heavy winter pruning has by far a more detrimental effect than summer pruning. Winter pruning, since branches are without leaves at this time, does not make the change in appearance in the tree that the same amount of pruning would do during the summer, for this reason one is apt to cut off enough to influence detrimentally the setting of the fruit.

By the time the trees are old enough to bear heavy crops it will be necessary to brace them during the bearing period. This is accomplished by placing brace sticks at convenient places along the branches or it may be done by carrying the weight of the branches on ropes attached to a central mast, consisting of a two by four or smaller sapling pine or fir, standing five or more feet taller than the tree. A more permanent system is to place galvanized screw eyes in the larger branches attaching them with galvanized wire to a ring acting as a swivel for all the brace wires.

TOP WORKING. Many people have discovered, at the time the trees come into bearing, they had planted undesirable varieties. This has necessitated top working the trees. In top grafting, while some cut low on the tree removing practically all the main branches, this method has proven less desirable than higher cutting only cutting

the branches when they are three inches or smaller in diameter. In these stubs two to four scions are inserted, the desirable one being retained after it has produced a desirable growth to show that the scion will do. Some recommend removing the entire top of the tree previous to top working. While in many cases this practice proves to be a good one, leaving a portion of the top very often gives better results. A portion of the top thus allowed to grow provides an outlet to water and plant foods taken up by a strong root system, thus preventing as great a shock to the root system as when the entire top is removed.

THINNING. Under suitable conditions for the setting of fruit, it oftentimes becomes necessary to *thin* the young fruit following the June drop. In cases where proper thinning has been done from the earliest date of bearing fairly average annual crops are obtained by thinning all the fruit from *half the spurs* allowing the remainder to bear *one or two apples*. The only serious objection to leaving two apples on a spur is the formation of suitable place where the codling moth may enter the fruit without much difficulty. The plan where *an apple* is left on *each spur* does not present this objection. Red apples are allowed to color more perfectly than they can where two fruits touch, an objection not met with on yellow or light colored varieties. Leaving *two apples on a spur* has an advantage also in securing heavier yields from light bearing trees or during light producing seasons. Both of these systems of thinning have their advocates and are practicable. Thinning should be done by the use of light pruning shears made especially for this purpose.

DISEASES AND INSECT PESTS.

The diseases and insect pests may be divided into the so-called *physiological* disorders, *bacterial* diseases, *fungus* diseases and *insect* pests.

The diseases known as *winter injury* or *rosette* is becoming more abundant and destructive. This disease occurs on one-year-old budded or grafted stock in the nurseries and on trees of all ages and varieties presenting all sorts of degrees of injury. As a usual thing the disease appears in connection with some specific tree trouble or is present on trees grown under very uncongenial conditions. So little is known concerning it, little more than cautioning people to take care not to plant infested trees can be recommended at this time. Should the disease appear in bearing trees the land should be given

proper management to put it in first class physical condition. The trees should be stimulated by the use of a fertilizer and all of the diseased branches removed. During pruning, cutting back should be well below the lowest point of the discoloration or spotting of the tissues. One who does not observe this precaution will accomplish little or nothing through the pruning method.

Baldwin spot, dry rot, etc., are the terms used to designate the presence of dark colored groups of cells occurring in some portion of the flesh of the fruit. This trouble was very abundant during the season 1912 in many apple orchards, in fact, it was not uncommon in every variety grown under certain conditions. This trouble is a physiological one and is induced by uncongenial food and climatic conditions. *Very little is known concerning this disease.* An inspection of a large number of orchards, studies on the effect of various forms of fertilizers on the diseased trees and good cultural methods shows that the trouble does not occur in orchards where the temperature of the soil is held fairly constant and a uniform supply of moisture is given the tree during the growing season. It would seem advisable to stimulate weak trees by the use of commercial fertilizers, barn yard manure or compost, to give the trees clean cultivation until rapid growing weather in the spring, at which time the ground should be sown to some quick growing shade crop, after which, sufficient moisture should be given at frequent intervals to supply the cover crop and trees, and at the same time allow proper bacterial action and the liberation of plant food within the soil.

Among the diseases, *fire blight* or pome blight is the most dreaded of all those induced by organisms. This disease is caused by a bacterium which lives in diseased bark during the winter. With the advent of growing weather gum containing large numbers of bacteria ooze from some of these cankers. Bees and other insects feed upon this gum as well as upon the nectar during blooming time. Bacteria are thus transferred from the hold-over cankers to the blossoms in which place they work in the nectaries, finally attacking and killing the spurs and branches. The disease will usually continue to work in the branches until the tree is dead, continuing for several seasons in some cases before the host succumbs. After the disease begins to run in the branches the only method of control is to *cut out all the diseased cankers or branches*. In cutting, the branches should be removed about a foot *below the lowest point*

of *discoloration*. If cankers are trimmed out the bark should be cut well from above and below since the disease spreads most rapidly lengthwise with the branches especially upward. During pruning all tools should be thoroughly saturated *with corrosive substance* (one to one thousand parts of water) often enough to keep them wet. Every pruned surface must be swabbed with the antiseptic. All the cutting *should be burned at once*.

CROWN GALL. This disease may appear in several forms, the two principal ones being either a large wart or a group of abnormal roots appearing like a brush and known as the hairy root form. The hairy root form of crown gall is apparently more injurious and dangerous than the gall form. For this reason one should familiarize himself with the hairy root form so that he can easily recognize normal and diseased roots.

INSECT PESTS.

Every person intrusted with the care of fruit trees should become familiar with the few facts which are so essential to the proper and effective control of all forms of insects. For the convenience of the apple grower we may divide the pests into *two large groups*—those that *chew* and swallow their food and those that *suck* the juices of the plant. A careful observer can easily determine the kind of damage an insect is doing and can then apply the right kind of spray to control the pest. The *stomach poisons* utilized at the present time are *largely arsenicals*. Arsenate of lead has proven to be the most serviceable since this compound does the least injury to the tree and fruit and controls the pests if the same has been properly applied. For *all insects that suck* their food *contact sprays must be used*. Of this class there are several, the kind used depending on the insect to be controlled and the kinds of sprays with which the same is to be mixed if a mixture is to be used. *Lime sulphur*, *nicotine solution*, and *kerosene emulsion* are the most used of the contact sprays.

The most common of the insect pest of the apple is the *codling moth*. The fact that the insect passes *the winter* in the *worm stage*, then changes to a chrysalis, from which the adult comes forth to lay the eggs, is known to every one.

All orchardists must admit that the number of applications of spray needed to keep this pest under control should be timely and thorough. The number of applications generally cannot be agreed

upon. The writer recommends three sprayings. The first and most important is the *calyx spray* and should be applied without fail. The next in importance is the spray which should be applied just as the second brood of worms begin to hatch, which usually occurs between the 1st and 15th of August. An application just preceding the emergence of the first brood of worms is necessary in all cases where there are enough to warrant spraying. The calyx spray should be applied using a *driving spray* nozzle while the other applications may be applied with a *mist spray* type if so desired. All the applications must be thorough and at the rate of one to two pounds of arsenate of lead to each fifty gallons of water.

The aphides attacking the apple are the *green, brown and wooly species*. All are killed by *contact sprays*. Black leaf 40 and soap applied just before the blossoms open gives the best results of all applications made toward the control of the pests. Spraying should be thorough and the *spray driven into* all the crevices in the bark and limbs of the trees so that all exposed pests other than the aphides appearing on the tree at this time may be killed.

The *leaf hopper* is becoming more abundant each year. In some orchards the damage amounts to considerable and steps are being taken to control the pest through spraying. Since the *eggs are deposited in the bark* of the tree during the autumn one must observe the emergence of the nymphs as they make their appearance early in June of the following year. Observations should be made each day until the time the eggs have hatched. The spraying should then be done before any of the forms produce wings. Black leaf 40 and soap gives the best satisfaction. It must be applied thoroughly and only on the under surface since all the insects are feeding on the lower side. In some experiments kerosene emulsion gave perfect results. The emulsion was diluted 1 to 16 parts of water. Care must be taken to have the emulsion made perfectly or damage to the foliage may occur.

During the past two years the *red spider* has done considerable damage to the foliage. The first precaution to be taken is the banding of the trees with a tangle foot to catch the mites as they crawl up the tree during the spring, many of them hibernating in the ground, under flakes of dead bark, fallen leaves and other materials that may afford a shelter. It is very hard to kill the eggs and for this reason it is advisable to spray as soon as the first few mites ap-

pear and before they have an opportunity to spin webs and lay eggs.

The *apple thrips* made its appearance for the first time in some of the apple orchards. In case spray is applied to control the aphides no further spraying should be necessary but in case of poor results black leaf 40 should be applied with the calyx spray for the codling moth.

The *San Jose Scale* is so well known it is sufficient to say that spraying with *lime-sulphur* during the spring just before the buds begin to swell will eradicate the pest provided the work has been done thoroughly and the spray is of the required strength.

Crown rot of the apple tree caused by *Amillaria Mellea* is one of the serious tree diseases which has not become well enough known for people to appreciate how destructive the same may become. Very frequently it happens that a tree is beyond repair by the time one is aware that anything is wrong. Careful watching and timely work is absolutely necessary. As soon as the autumn rains begin many of the infested trees may be *located* by the presence of one or more *brown mushrooms attached* to the collar of the tree just below the ground. Each tree should be marked at once as the mushrooms decay very quickly. Early during the autumn remove the earth from around the crowns of the trees and if the bark is dead all the dead portions should be cut out and the wound left open so that it may dry for two or three days after which the exposed wood should be coated with thick *Bordeaux mixture*. It is advisable to leave the hole open around the tree until later. It is suggested that the bases of all these trees should be coated with a layer of a mixture of equal volumes of dry pulverized limestone and sulphur after which the dirt may be put in place. The preliminary work has given good results and the suggestion is made that this be given a very thorough trial in order to determine the efficiency of the treatment. Thick *bordeaux mixture* applied in the same manner will give good results.

Anthracnose is easily controlled through spraying with *Bordeaux mixture* or *lime sulphur* *following the gathering of the fruit and preceding the fall rains*. Many times it is impossible to do the spraying during autumn owing to a rush of work. In sections where the rainfall is light during the spring and summer it is possible to do the work in the spring previous to the unfolding of the leaves. The spray applied at this time remains on the tree and is as effective as an autumn application. In sections where the autumn rains begin

early, and all of the time is needed for work in the orchard other than spraying, preliminary tests with a Bordeaux petroleum mixture gives the desired results. This spray has the advantage of being a combined fungicide and insecticide and at the same time is effective through long periods of time since the same will not wash off.

Apple scab is the most perplexing of the fungus diseases of the apple. Since the *fungus* causing the disease *winters in the fallen leaves* it is good practice to destroy as many of the fallen leaves as possible by plowing, etc. An *autumn application* of winter strength *Bordeaux mixture* before the leaves drop in autumn does much good unless the climatic conditions the following year are favorable for a rapid spread especially late during the summer or at picking time. In orchards where the disease appears with regularity season after season it is perhaps the best plan to spray with *Bordeaux mixture* (4-4-50) just before the blossoms open. A second spraying with lime and sulphur (1-32) may immediately follow the dropping of the calyx. Should the fruit be of some size and the conditions otherwise unfavorable some spray injury from this application may be expected. After the apple has grown to some size and has become smooth applications of either lime and sulphur or Bordeaux do not injure the fruit although the residue of the spray on red varieties prevents them from coloring uniformly.

Powdery Mildew is not to be considered a very serious disease although under some conditions the fungus, if not checked, dwarfs the leaves and stems and severely injures the crop. A thorough spraying with sulphide of iron keeps mildew in check. This spray is a valuable one since the mixture aids in the control of apple scab and various insect pests such as the mites.

The present prices for fruit makes it advisable to reduce the cost of production. Up to the present time little attention has been paid to working out a spraying system that can be followed without interference with the routine work of the orchard and that not only keeps the pests under control and at a less cost but does the trees and fruit less injury. The following spraying calendar may be examined with some profit as the scheme of spraying limits the sprays to four or five per year:

Spraying Schedule for the Year	Orchard Practice with Spraying	Kind of Sprays Used	Time to Do the Spraying	Notes
FALL— Anthracnose	Cut out badly diseased and dead branches	Use 4-4-50 bordeaux mixture before the fruit is gathered, or 6-4-50 bordeaux or lime-sulphur (winter strength) immediately after fruit is gathered.	Before the fall rains begin. When the diseases are abundant two applications three weeks should be made	Anthracnose and apple scab fungus both cause disease of the fruit held in storage. Spraying the fruit before picking apparently controls the disease in the orchard and prevents the spread of the fungi in stored fruit.
Apple scab (fungus)	Destroy diseased and fallen leaves by burning or cover them up by plowing.	Lime-sulphur (winter strength.)	After the leaves have fallen	Every portion of the plant must be coated, even the smallest twigs.
San Jose scale	Cut down and burn all infested plants of no economic value.			
LATE WINTER— Annual House Cleaning Powdery mildew Red spider Brown mite Codling moth Woolly aphids Aphis—Eggs of green and brown San Jose scale	Prune the trees, removing all dead and diseased parts of tree. Clean out all wounds and scrape the flakes of bark from trunks of all trees. Burn the rubbish at once. This work should precede spraying.	Lime-sulphur (winter strength) Bordeaux 4-4-50 or lime-sulphur 1-32. Black Leaf 40 1 gallon, whale oil soap 40 lbs., water 1000 gallons (2) Black Leaf 40 1 gallon, lime-sulphur 32 gal. water 1000 gal. Arsenate of lead 1-50 or 2-50	(2) Before the flower buds begin to open. Apply while the terminal buds of flower clusters are opening. Follow the calyx spray for the codling moth. Follows application of bordeaux, but cannot be mixed with it. Before the flower buds open. Before the calyx closes	Removing all diseased and dead parts and scraping the flakes off from the trunk and larger branches, exposing all hibernating pests so that the spray will reach them, should be practiced. Every portion of the plant must be coated, even the smallest twigs. Bordeaux gives the better results, but only controls the fungus. High pressure and a driving spray are required to thoroughly wet every portion of the plant. Careful work in applying the spray is the only practice that will give the desired results. [2] Controls both apple scab and insect pests. Lime-sulphur 1-32 and arsenate of lead 2-50 may be mixed; controls both scab and codling moth. This is the most important of the sprayings for codling moth. Use a driving spray nozzle. If the trees are drenched the weaker spray may be used, otherwise use more poison. The June spraying may be omitted under the most favorable conditions, but is recommended since the application is the cheapest form of insurance. Use a good pattern mist spray nozzle. Spray lower sides of the leaves. Requires a high pressure and very careful work. Wet every leaf.
Codling moth	Remove hands to catch codling worms and destroy the worms.	Arsenate of lead 2-50	[1] Spray June 1-10 [2] Spray Aug. 1 to 10. After the apples become smooth. As soon as insects appear and before web becomes too thick (red spider), or adults become winged [hopper] As soon as the disease appears.	
SUMMER— Codling moth		Lime-sulphur 1-32 or bordeaux 4-4-50 Black Leaf 40 1 gal., whale oil soap 40 lbs., water 1000 gallons. Sulphide of iron 8-100		
Apple scab				
San Jose scale Red spider and leaf hopper				
Powdery mildew				

In **applying sprays** one must bear in mind the following facts:

Fungus diseases are prevented by coating the plant to keep the parasite from getting a foothold. Diseased plants seldom can be cured, since the parasites are internal. Any spray strong enough to kill an internal parasite would kill the host.

Insects either **chew** and swallow their food or **suck out** the juices of the plant. **Stomach poisons** will kill those that **eat** parts of plants, but **contact sprays** must be used to kill those that live on the **juices** of the plants.

Only parts of plants coated with spray are protected from fungus diseases and chewing insects. **Contact sprays are only effective** when they **come in contact** with an insect.

Be sure to **use the right kind of spray** and to apply the same at the **right time**. Unless the work is done at the right time, poor or no results will be secured.

Use **plenty of spray**, and apply the same with **good pressure**. During the season the leaves are off the trees spray with sufficient force to drive the solution behind the buds and into every crevice and angle of the tree. Application during the spring and summer must be thorough. Thorough spraying requires the right type of nozzle. Coat the leaves and fruit as may be necessary to combat the pests effectively. Thorough spraying with the right spray at the right time is cheap orchard insurance.

Use an 8 or 10-foot spray rod and an elbow coupling to set the nozzle at an angle of 45 degrees.

Do not spray unless you know the reason for doing the work.

Make a study of each fungus or insect that is causing you trouble in the orchard.

GATHERING AND STORING THE FRUIT.

The kinds of ladders, picking utensils, and the management of the picking crews are seldom agreed upon by any of the more successful apple growers. Each person has worked out a system satisfactory to himself and one which works out very nicely with the conditions that must be met. The time of picking the fruit is an important point and one which every one should understand. At the present time the apples are usually gathered at the time the stem separates from the spur by giving the apple a backward twisting motion. **Proper maturity at the time of picking** is much more

important than formerly supposed. There is a tendency to allow some varieties, and especially the red ones to hang to secure color, much to the shortenitg of the life of the apple. Care must be taken to prevent over-ripening as this one factor is largely responsible for the poor keeping qualities of some of the best appearing apples. A very **serious mistake** and one that is frequently made is to allow the **fruit to stand in boxes in the orchard** often-times exposed to the direct rays of the sun for a period of two or three days. The alternate cooling and heating of the fruit causes it to ripen very rapidly. Apples may be left standing in the field during the night in order to allow them to cool thoroughly, but they should be taken to the packing shed early enough the following morning so that the temperature of the fruit does not begin to rise. **Delayed storage frequently shortens the life of the fruit** several days, weeks or even months. It should be the rule to get the fruit from the trees to the warehouse in as short a time as possible with the possible exception of taking advantage of the night cooling of the fruit.

Dividing the fruit **into the grades** is a very hard task. There is a **tendency** to attempt to **place** the fruit in the **grade above where it belongs** than in a lower grade. The results of the grading will be the best index of the ability of the sorter and oftentimes shows very plainly the disposition of the grower. An honest man puts up an honest pack.

When it comes to grading the fruit **uniform grades** are only secured through **cooperative work**.

Market conditions require **careful grading** of the fruit. The ideal system is where the fruit is brought to the warehouse in the orchard boxes to be graded by a crew working under the supervision of one man. In this way the grading may become more uniform. The grading will vary greatly and especially toward the close of the day when the crew is tired. As a guide to the grading crew each person should be given a set of brief rules to guide him, also taught the various injuries that occur on the apple and how to recognize them.

Grading may be greatly facilitated by the use of machinery.

Where facilities admit storing the fruit should be placed in cold storage loose in the orchard boxes and packed out when needed for shipment. As actually handled, the fruit is picked, sorted and packed out at once. When this method is followed the apples should

be placed in common or cold storage at once following packing.

Storing the apple is very important. In common storage, in case the house is built for ventilating, the ventilation should be adjusted at the time the temperature outside is lower than within the house to allow the cold air to enter. Before the temperature of the air begins to raise, the house should be closed tightly so as to hold the cold air in the room during the hotter portion of the day.

STUDY APPLE-GROWING.

An immense amount of information, much of it new and applicable to your work, is being published by the United States Department of Agriculture, State Experiment Stations, and other institutes, as well as by individuals.

To keep in touch with important and new literature:

1. Write the Pacific Horticultural Correspondence School for a list of the books and pamphlets that contain information of value to you in your work.

2. Secure a copy of the Yearbook of the United States Department of Agriculture from a Senator, Representative or Delegate in Congress.

3. Farmers' bulletins, circulars and other similar publications written in a manner in which they are of use to the farmer can also be had from senators, representatives and delegates in congress.

4. At the close of each month a monthly list of publications is issued giving full information with regard to the contents and how to obtain the publications of the department for the month is prepared for distribution. This circular is sent regularly to all who have their names placed on the mailing list to receive it.

5. Secure all the publications of your state experiment station. Each station has a mailing list of all persons who desire the publications as they appear from time to time.

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